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MICROTEACHING: STUDENT-TEACHER ACQUISITION OF TWO QUESTIONING SKILLS FOR USE IN A LABORATORY SETTING

BY

CHRISTOPHER JOHN BAKER

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Micro-teaching: student-teacher acquisition of two questioning skills for use in a laboratory setting" submitted by Christopher John Baker in partial fulfilment of the requirements for the degree of Master of Education.

to

ALPHA and OMEGA

ABSTRACT

Theory and empirical evidence suggest that students, who wish to extend the range of their classroom skills by participating in laboratory training, may need to teach lessons in an as yet undetermined number of laboratory settings. Learning theory also suggests that students and supervisors would benefit from a knowledge of the approximate number of practice lessons that should be taught in each of these successive, environmentally altered, training situations.

The present investigation was designed to determine the number of microteach lessons with feedback that a sample of student teachers would need to teach in order to acquire two pedagogical skills for use in a laboratory training environment. The two teaching behaviors were: (1) redirection and (2) asking questions that require a pupil to use higher cognitive processes.

Twenty-seven fourth year Bachelor of Education students were divided among five schools, each group being assigned randomly to either a treatment or control condition. Three experimental groups differed in the number of microteach lessons taught after viewing instructional films. Pre and post treatment frequency scores for redirection and per cent scores for high level questions for each student were calculated. The mean performance change score of each group for each skill was compared to determine the approximate number of lessons necessary for the acquisition of each questioning skill.

The *t*-test and analysis of variance were used to analyze the data. The salience of practice which includes feedback (self-assessment and examiner critique) was demonstrated over groups. The students acquired

the skill of asking high level questions in the practice environment after teaching one microteaching lesson and receiving feedback on their performances.

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Chapter I

INTRODUCTION TO THE STUDY

Statement of the Problem

Evidence is accumulating to suggest that present procedures for training student teachers in the use of classroom skills may be inadequate (Gage, 1970; Gall, 1970; Alberta Teachers' Association, 1973). It is proposed that more effective techniques for training students in the use of teaching skills are available for adoption by teacher education institutions. The implementation of these techniques would involve a change in focus from more general teaching behaviors (e.g. involving students) to more specific subskills (e.g. redirecting questions). Despite the experimentally established and logically perceived advantages of the available techniques, additional research is necessary before both the potential and limitations of each for training students are determined thoroughly. The general aim of this thesis is to investigate one of the proposed techniques, microteaching.

Teacher education institutions and researchers which incorporate microteaching within their training procedures, generally, have adopted the laboratory training paradigm developed at Stanford University during the mid- to late 1960's. In implementing this model researchers and institutions alike have assumed that the paradigm is theoretically sound for training students in skills to be used in the classroom and that the number of practice sessions necessary for the acquisition of a skill may be determined arbitrarily. The consequences of accepting these assumptions have been that students have participated in repetitive practice

of a skill in a specific, unchanging environment, while a minimum number of microteaching lessons has been considered adequate practice for the acquisition of a skill to be used in the classroom. Dialectical and empirical evidence suggests that training students in teaching skills for use in a classroom is a lengthy procedure and may be achieved through repetitive practice in systematically varied laboratory environments. To avoid increasing the specificity of student learning to the particular stimuli and responses practiced in each training environment, it is essential to be aware of the approximate number of practice lessons that students need to teach to acquire a skill for use in that specific training environment. The specific purpose of this thesis, therefore, is to determine the number of microteaching lessons with feedback that student teachers will need to teach before acquiring two specific skills for use in their initial training environment.

The Traditional Means for Implementing the Instructional Episode of Teacher Training Paradigms

Following an examination of preservice teacher education programs offered at most U.S. colleges and universities, Borg et al. (1970) suggest that these programs may be divided into three major categories. The first category emphasizes "curriculum content," and involves the student teacher in the acquisition of subject matter, which he will be expected to transmit to his pupils. The second category emphasizes "professional knowledge" and exposes the student teacher to such areas as learning theory, child development, and educational evaluation. The third category which emphasizes "classroom skills and behavior," attempts to train student teachers in padagogical skills through involvement in methods

courses and student teaching. The Faculty of Education at the University of Alberta also incorporates these three categories into its teacher education program. The instructional episode within the training paradigm adopted by the Faculty for the purpose of producing teachers capable of successfully implementing teaching strategies in a regular classroom consists of three parts: (i) Presentation, (ii) Practice, and (iii) Feedback. The means for implementing each of the three components of this instructional episode are respectively: (i) methods (curriculum and instruction) courses and observations of teachers, (ii) student teaching, and (iii) supervisor feedback during student teaching. Despite the continued implementation of the conventional preservice teacher education program at most colleges and universities, however, research suggests that there has been little change in teacher classroom verbal behavior over a time period of fifty years.

Hoetker and Ahlbrand (1969) indicated a

> remarkable stability of classroom verbal behavior patterns over the last half century, despite the fact that each successive generation of educational thinkers, no matter how else they differed, has condemned the rapid-fire, question-answer pattern of instruction [page 163].

Gage (1970) suggests that teachers have fallen into this rut because they are ". . . imprisoned by their technical poverty . . . ." In support of this contention, the Albertan Principals' report on first year teachers (1973) suggests that many graduating teachers lack the basic skills required for successful teaching. Two major reasons for this "technical poverty" among teachers are proposed. Firstly, the continued reliance by teacher education institutions upon inadequate means for implementing the instructional episode described above. Secondly, the persistent

refusal of the great majority of these institutions to simplify many of the complexities of teaching methodology to a series of interrelated operationally defined behavioral skills. These skills the average teacher could understand and with an appropriate training program acquire. It is suggested that the means for implementing the instructional episode of the training programs, each with its global orientation toward the teaching act, do not provide (1) controlled presentation of specific teaching skills, (2) adequate opportunity to acquire and develop these skills through repeated practice or (3) meaningful, objective feedback to the student to ensure a functional understanding of each skill. Generally, effective training in such fundamental teaching skills as questioning and reinforcement procedures has not been provided.

A survey of educational methods courses in four-year teacher education institutions in Wisconsin (Willis, 1968) suggests their similarity with methods courses offered to elementary student teachers at the University of Alberta. The discussion and lecture tend to be the principal means by which information is disseminated during these on-campus courses. As a result, comments about teaching are more abstract and general than concrete and specific. Students enrolled in methods courses tend to be exposed to

> . . . vague generalities, such as "Individualize your instruction to meet each pupil's need" rather than [to] systematic definition and development of specific teaching skills (Borg et al., 1970, p.24).

Even when the teaching act is occasionally specific and concrete, e.g., when students observe instances of teaching by peers or experienced teachers, the analysis of what is perceived may be neither systematic nor sufficiently detailed enough to provide for student understanding

of the cause-effect relationship between specific teaching skills, and student behaviors. It seems that methods courses generally do not present teaching as a set of interrelated, specific teaching skills, and it is also noticeable that there is little opportunity for the immediate and repeated practice of teaching behaviors. Thus, far from developing a functional understanding of essential teaching skills and an ability to reproduce them, methods courses may only be training student teachers to talk about teaching. The second feature of the first component of the instructional episode, classroom observation, is also limited in its capacity to develop a functional awareness and understanding of specific teaching skills.

Though occasionally scheduled as a requirement in methods courses, classroom observation more frequently occurs spontaneously during student teaching sessions. The principle of having teaching models available for student teachers to observe is useful for the acquisition of specific teaching skills. Several weaknesses inherent in present classroom observation programs, however, preclude the most effective use of model teachers: (1) the quality of the model teachers is uncontrolled; (2) directions indicating what a student teacher should observe are minimal; (3) the opportunity to discuss specific points of interest before, during or soon after a lesson is usually not made available, and (4) the variety of lessons and teachers available for observation is frequently limited.

Teacher education institutions understandably prefer to select co-operating teachers from the most skilled teachers available. Heavy enrolments in teacher education programs and the resultant increase in the demand for co-operating teachers, however, must inevitably decrease

the number of skilled teachers available. Thus, many students will be placed with teachers who lack the teaching behaviors students are sometimes recommended to observe. It must also be apparent that even skilled teachers are not able to perform consistently at their highest level of competence. Therefore, student teachers under the present system will observe varying degrees of competence in teaching. The significance of this for the development of student-teachers may be seen in terms of research which suggests that co-operating teachers do influence the attitudes and teaching styles of student-teachers (e.g. Yee, 1969; Stoller, 1964; Seperson & Joyce, 1971).

Once assigned to a co-operating teacher, the student teacher often receives little direction as to what he should observe when viewing lessons at the school. The few directions received frequently are couched in vague, general terms:

> Student teachers should observe . . . the teacher's general approach to planning, discipline, relationship with pupils and to his general attitude toward his role as teacher (*Student Teaching Handbook*, University of Alberta, 1974, p. 10).

The lack of specificity in the directions the student teacher does receive is due in part to the complex interrelationship of numerous teaching skills which comprise a teaching style. Faced with this complexity, it is difficult to forecast with any sense of precision the specific skills a teacher will use in a classroom lesson, let alone the order and frequency with which they may be used. Left without specific directions for what to observe during a demonstration lesson, however, the student teacher has as much chance of perceiving poor teaching behaviors as he has of missing effective teaching skills.

Given the doubtful assumption that sufficient time is always available, the complex interrelationship of teaching skills used during a lesson also makes it difficult for a teacher to discuss more than the general methodology of his lesson with a student-teacher prior to teaching that lesson. Furthermore, throughout a lesson, a teacher invariably is concerned with the need to cover a designated portion of the curriculum. Understandably, this preoccupation with pupil learning distracts the teacher from systematically discussing, with a student teacher, the use of specific pedagogical skills. Scanty notes and imperfect memories prevent anything approximating a detailed analysis of teaching skills following the lesson.

With each student's assignment to a particular teacher and only periodic attendance at the schools by student teachers (see following section on practice teaching) during the week, the present system prevents students from systematically observing both a variety of teaching styles and the teaching of different subjects. The complex problems which would be involved in scheduling model teachers for frequent and systematic observation would make it extremely difficult to extend the present system to overcome this limitation.

In addition, students faced with the need to make extra time available for travel to and from schools would most likely find the organization of their lecture schedules extremely difficult. So poorly have classroom observations and methods courses presented teaching skills to student teachers over previous years that Gage (1970) has found it necessary to conclude that,

> Teachers are expected to rediscover for themselves the formulas that experienced and ingenious teachers have

> acquired over the years. Each generation of teachers benefits too little from the inventions of its predecessors. Too little of the wisdom of the profession gets saved and passed along for the benefit of the novice [p.195].

While methods courses and classroom observation inadequately present essential pedagogical skills, the second component of the instructional episode, student teaching, appears to be unsuitable for the practice of solitary teaching skills and for the provision of objective feedback.

The concept of student teaching must remain an indispensable unit of a thorough teacher training program. Through exposure to a number of co-operating teachers, the student has the opportunity to observe a variety of teaching strategies. Teaching in a regular classroom will permit the student, who possesses a repertoire of teaching skills, to refine and develop these specific behaviors into preferred, coherent and productive teaching strategies. However, the role of student teaching as the only means by which students may practise teaching skills seems ill conceived. Apart from the limitations imposed by the complex interrelationship of teaching skills during a thirty minute lesson and the insufficient time available for students to teach and supervisors to consult with trainees, student teaching is plagued with inadequate diagnostic and remedial techniques.

Student teaching, as it is implemented today, neither alows students to concentrate on the acquisition of a specific skill to the temporary exclusion of others, nor permits him initially to acquire these skills in a low threat environment. The spontaneity of classroom interaction and the preoccupation with student learning are just two aspects of a lesson which prevent a student teacher from systematically working

through a specific teaching skill until it has been perfected. It would be an extremely difficult requirement, for example, to expect a student to concentrate on asking higher cognitive questions during a lesson while also having to use many other skills to impart information, control the class, etc. Furthermore, the student would be expected to attempt to acquire this skill in an environment fraught with potentially embarrassing failure and often void of any positive reinforcement. Not only is the student expected to contend with the methodological complexities of a regular classroom lesson but he is permitted little time to develop a teaching skill.

Student teachers at present, relative to their four years of attending courses at a university, spend very little time in the schools where they hope to eventually teach. During their second year, University of Alberta elementary student teachers are required ". . . to attend [an] assigned school one day per week for ten weeks in either term", while in their third year they ". . . will be placed in classrooms for a minimum of three half-days per week in either term I or term II, plus five full consecutive days in the spring following final examinations" (*Student Teaching Handbook*, 1974-75, p. 6). The sum total of practice teaching in four years, therefore, is approximately twenty-nine days (excluding holidays). This figure, however, conceals the lack of continuity which characterizes the students' practice teaching experiences. Faced with the realities of brief, separated occasions in which he has the opportunity to teach, the student teacher has little scope for the development of a unit of work in any subject. The content of his lessons is determined by the co-operating teacher's program. Responsible for pupil

learning, the student teacher has little time to be thinking of particular aspects of his teaching methodology during a lesson.

Responsible for the supervision of a group of student-teachers in different schools at various times during the week, the supervising professor, who is invariably distracted with teaching commitments at the University, frequently finds that he is unable to regularly observe the scheduled lessons of his assigned students. Thus, because observations of student teachers' lessons are infrequent, the supervising professor's comments are:

> . . . usually wide ranging and all-inclusive . . . the supervisor naturally tries to accomplish as much as he can in each [session]. In traditional terms, this means discussing with the teacher all the problems he notices during his visit. Anything less, he believes, would be slighting his job. Such a shotgun approach however, is instructionally weak and motivationally damaging. Even if the teacher had the desire, he probably could not tackle all the problems his supervisor might identify at any one time. Discouragement would probably be the result (Cooper & Seidman, 1969, p. 21).

It needs to be emphasized that the average lesson of thirty to forty minutes not only generates an unnecessary overabundance of pedagogical issues to discuss but it also detracts from the time available for the supervisor to provide systematic and constructive feedback on the basic teaching skills every student teacher needs to understand and acquire. In addition, periodic observance of a student teaching various subjects in different grades would not seem to be conducive to a systematic analysis and guidance of that student's teaching behaviors. The limited amount of time available for the supervision of student teachers, however, only partly determines the effectiveness of supervision. Conventional methods for recording one's observations of a lesson frequently

prevent a supervisor from meaningfully communicating his suggestions for improving a lesson to a student teacher.

More often than not, descriptions of the student teacher's classroom behavior are based upon the supervisor's notes and the student's memory of his performance:

> . . . to utilize this feedback, the teacher has to see himself as somebody else has seen him, and he must relate these perceptions and judgements to his own (McDonald & Allen, 1967).

To compound this difficulty, it frequently occurs that the supervisor and student do not share a common perception of what was done during the lesson, how it was done and what the effects were (McDonald & Allen, 1967). If student and supervisor, at the completion of a lesson, commence from these opposing viewpoints then it is understandable why many students fail to comprehend the relevance of supervisors' comments. During a lesson the supervisor must concern himself with a general impression of a student teacher's performance. The pace of the average lesson prevents a concise written analysis of the sequential, interrelated components of specific teaching behaviors or the numerous teacher-student interactions. Consequently, the supervisor's description of the lesson refers to general headings such as "motivation," "questioning," "control," etc. Specific examples of these behaviors are rare and because of this there can be little meaningful analysis of why particular behaviors or sequences of behaviors resulted in undesirable or desirable teacher-student interactions. Even if supervisor feedback identified specific teaching skills for student teachers to acquire, student teaching presently does not provide the means by which students may practice particular behaviors.

To conclude, the means for implementing the instructional episode of

the teacher training paradigm adopted by the Faculty of Education at the University of Alberta, not only appear to have presented essential teaching skills inadequately to students but also appear to have been unable to provide for repetitive practice of each skill and the immediate receipt of objective feedback, following each practice session. In short, the means for implementing the instructional episode appear to be inadequate for developing student acquisition and functional understanding of specific teaching skills.

Chapter II

ALTERNATIVE MEANS FOR IMPLEMENTING THE INSTRUCTIONAL EPISODE OF A TEACHER TRAINING PARADIGM

A training component proposed for teacher education programs, which may incorporate the technical skills approach to teaching, is described by a paradigm (Fig. 1) combining adaptations of two models proposed by Glaser (1962) and McDonald (1965).

The Components of an Instructional System

The modified system presented in Figure 1 utilizes four of the five components of Glaser's instructional paradigm (Glaser, 1962, pp. 5-21). The first component consists of the delineation of the instructional goals. The student with personal experiences, knowledge, skills and ability then influences the system. The third component, instructional procedures, is used to modify student behavior. The fourth component, terminal performance, is assessed in terms of the instructional goals. The loop connecting terminal performance with instructional goals also represents the input an instructor receives from an overall evaluation of student performances during training which may assist him in restating his goals for future implementations of the training program. The instructional procedure component in Figure 1 is a modification of Glaser's model, being expanded to incorporate the elements of the instructional episode proposed by McDonald (1965).

The Instructional Episode

Teaching in this study is considered to consist of a repertoire of

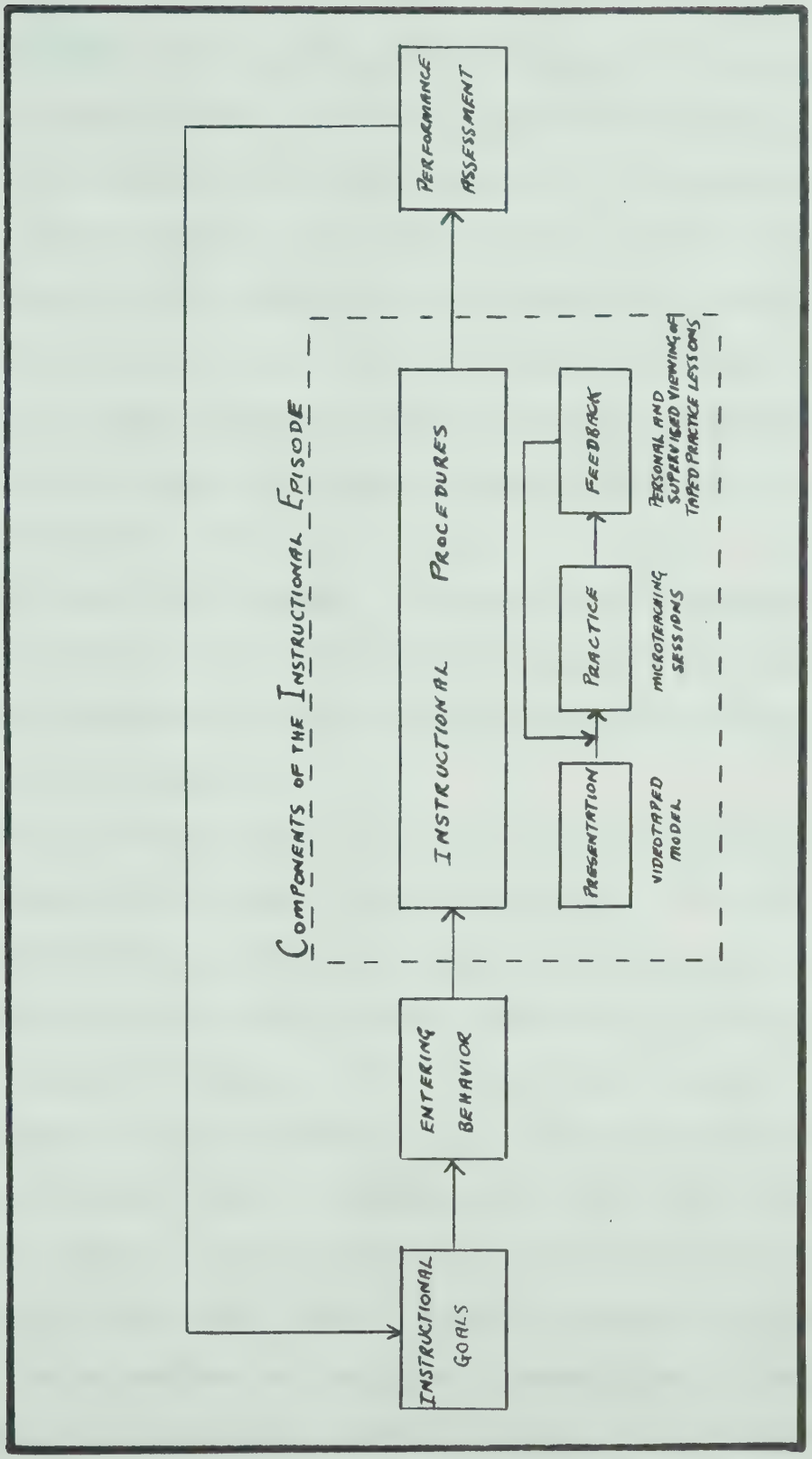

Fig. 1. A training model for teacher education programs.

behavioral skills which may be learned and practised separately before being integrated into complex teaching strategies by the professional teacher. McDonald (1965, pp. 89-91) proposes that an instructional episode, to be effective, needs three components: a response-guidance phase, a response-practice phase and a feedback phase. In Figure 1, these phases have been named: (a) presentation, (b) practice, and (c) feedback (Claus, 1968). During the presentation phase, the learner receives some form of guidance on the response to be acquired. The practice phase enables the student to repeatedly perform this response. The feedback phase provides the student with a means for ascertaining the correctness of his response. The two-way link between the feedback and practice phases is a modification of McDonald's paradigm. This loop represents consecutive practice lessons and associated feedback sessions (immediate or delayed).

There are various methods which could be used to implement the three phases of the proposed instructional episode. The skills approach to teacher training simplifies the complexity of teaching by isolating and defining specific teaching skills which are an integral part of the general practice of teaching. To encourage student recognition and understanding of teaching behaviors, each skill is described behaviorally. With recognition of specific teaching skills the student is able to isolate those behaviors which comprise each skill and make them the focus of training (Allen & Ryan, 1969). Through involvement in a training program, which provides for cued modeled presentations of skills and opportunity for repetitive, supervised practice in low threat micro-training situations, students will develop an awareness of the situational

factors that dictate the use of a skill and the probable effects of its implementation. With continued training, the student will be able to develop control over the skill in question, permitting him to use the behavior in a deliberate way to assist student learning. Equipped with a repertoire of teaching skills, students, during student teaching sessions, will be able to develop these separate behaviors into teaching strategies capable of successfully achieving instructional objectives.

> For this teacher, the teaching act involves decisions about when and where to apply his skills. For the individual so trained, teaching is not a series of happenstances, but a series of professional decisions (Allen & Ryan, 1969).

Experimental evidence, though limited, suggests that if a student teacher is to perform these skills competently in a laboratory setting, he needs to (1) observe a cued, modeled presentation of each teaching behavior (Orme, 1966; McDonald & Allen, 1967; Claus, 1968), (2) practice each skill soon after presentation in a low-threat, microteaching environment (Berliner, 1969), (3) receive objective and specific feedback on his progressive acquisition of each skill (McDonald & Allen, 1967; compare Acheson, 1964), and (4) if necessary, continue practising the skill in a low-threat environment with each succeeding practice session being followed by objective, specific feedback (Fitts, 1962; Copeland & Doyle, 1973). Since the present investigation instructed student teachers in the laboratory use of specific teaching skills, modeling was used as a means for presenting the criterion behaviors. The modeled skills were practised by the experimental subjects in microteaching lessons, while the feedback phase consisted principally of the subjects reviewing video tapes of their microteaching sessions, to see how closely they had matched the modeled behaviors.

1. The Advantages of the Filmed, Modeled Presentation of a Skill

Filmed, modeled presentations of teaching skills have several advantages for student teachers and supervisors: (1) the complexity of the average lesson may be reduced; (2) the quality of instruction is controlled; (3) the supervisor and/or film narrator cue the observer; (4) since the film may be replayed, discussion, following the lesson, may be conducted with reference to specific, concrete examples of behavior, and (5) it is logistically simple to present a variety of skills to students in this form. Firstly, with an emphasis upon teaching methodology rather than the completion of a portion of a curriculum, the average thirty to forty minute demonstration classroom lesson may be simplified in terms of its length and the number of teaching skills demonstrated. To assist student concentration and interest in the skill being presented, the lesson time may be shortened considerably. The complex interrelationship of teaching skills which characterize the average lesson may also be substituted with an emphasis upon a single teaching behavior. This emphasis would have the calculated intention of enhancing student awareness and understanding of that specific skill. Secondly, the quality of teaching observed by the student teachers may be controlled so that they are constantly exposed to a preferable standard of instruction. While for some skills the inclusion of only exemplars may be desired, the method of presentation is sufficiently flexible to allow for the inclusion of non-exemplars of behavior, if it were demonstrated that such a program would enrich the student's understanding of the teaching skill in question. Thirdly, both the supervisor and narrator may jointly prepare students for what they will observe during the filmed lesson.

This cueing before and during a lesson should ensure student observation of the salient aspects of the demonstration lesson. In addition, student understanding of why the acquisition of the modeled behavior is considered necessary for successful teaching could be developed by requesting them to read a detailed written rationale for the teaching skill prior to the showing of the film. Fourthly, the filmed recording of the demonstrated teaching skill permits the replaying of specific sections of the lesson. Discussions following the film may, therefore, be conducted with reference to specific, concrete examples of teaching behavior. While student misunderstandings related to the skill may be quickly and simply clarified, their functional understanding of a teaching behavior may be enriched through the supervisor's systematic reference to those significant elements of classroom interaction which precede and follow the modeled teaching skill. Fifthly, relative to the conventional training program, it is logistically simple to expose student teachers systematically to a variety of teaching skills. Whether the students are attending a university or participating in an extended practicum, the demonstrations of specific skills may be brought to the students. This arrangement results in a minimum of interference with school personnel and, because he does not have to spend time travelling or observing lengthy lessons, the student is left with additional spare time to analyze and practice using the modeled teaching skill.

2. *The Advantages of Practising a Skill in a Microteaching Environment*

Microteaching is basically a real teaching situation in which a brief lesson is taught to a small group of students. A sample of the variable aspects of microteaching includes the number and types of pupils,

the lesson length and the number of re-teach lessons. Usually, the lesson is of five to ten minutes duration and involves three to ten students. The microteaching lesson frequently is recorded on either video or audio-tape to provide objective feedback at the completion of a lesson.

The most significant advantages to be gained by using microteaching lessons to practice teaching skills are: (1) the simplification of the teaching act; (2) the opportunity to practice teaching skills in a low-threat environment; (3) the opportunity to engage in extended practice, and (4) the potential for systematic exposure to various types of pupils. Firstly, the scaled-down microteaching classroom reduces the complexities of the teaching act and enables the teacher to focus on the acquisition of a specific skill (Allen & Ryan, 1969). Secondly, while actively involving a student teacher in real teaching, microteaching permits the student to present his lesson in a low-threat situation. The experimental approach to the teaching act and the limitations placed on the number of pupils taught and lesson duration, each assist in alleviating the embarrassing consequences often associated with methodological errors. Thirdly, since microteaching lessons are not part of the regular curriculum and pupil learning is not jeopardized (Allen & Ryan, 1969), the student may practice the teaching skill until he is confident that he has acquired the behavior for use in that particular microteaching environment. Finally, student teachers may be systematically exposed to pupils of varying backgrounds, intelligence, abilities and ages before confronting large, heterogenous classes (Ryan & Allen, 1969). By observing the relative effectiveness of an applied teaching skill, when used with different types of pupils, the student teacher should develop

his functional understanding of that particular skill.

3. *The Advantages of Supervised Feedback which Incorporates a Video Tape of the Observed Lesson*

The supervisor of student teachers, who records their lessons on video tape, is able to (1) obtain a complete recording of the student teacher's lesson behavior; (2) reduce, if not eliminate, the potential disagreement between himself and the student regarding the methodological content of the lesson; (3) provide the student with a detailed analysis of his teaching method, and (4) regularly observe a student teacher's lessons. Firstly, with a video taped film of a lesson, one obtains a complete record of all teaching behaviors, both verbal and non-verbal. This complete record of a lesson also permits the supervisor to postpone the feedback session, if necessary, until a more convenient time. Immediacy of feedback with videotaped lessons does not seem to be critical for student learning (McDonald & Allen, 1967). Secondly, because lessons are videotaped, the student teacher and supervisor are more likely to agree as to what teaching behaviors were used during a lesson. The objective recording of the student's teaching behaviors should reduce any tendency for him to rationalize unpleasant feedback by assuming it was inaccurate or distorted by the supervisor (Perlberg, 1969). Thus, the supervisor is able to reinforce desirable behaviors, as well as effectively develop student dissatisfaction with undesirable behaviors. Thirdly, the supervisor may allude to specific, concrete instances of teaching behavior when discussing a lesson with a student. Because he is able to replay the lesson, in part or whole, the supervisor may reveal the *preceding and consequent* classroom behaviors associated with a specific teaching behavior. Systematic use of this procedure

should enrich a student's functional understanding of specific teaching behaviors and thereby develop an awareness that his classroom behaviors, whether deliberate or unintentional, are likely to influence student behavior. Finally, it is a simple procedure to instruct students in the use of video tape equipment. Henceforth, when the supervisor is unable to attend a student's lesson, a recording of the lesson may be made by the student. This recording is then available for replay in the school or university at a time convenient to both supervisor and student. Thus, together, student and supervisor may regularly observe the student's lessons to ensure a systematic and thorough analysis of his teaching methodology.

Despite the experimentally established and logically perceived advantages of the above instructional episode, additional research is necessary before both the potential and limitations of each component of the instructional episode for training student teachers are thoroughly determined. To this end, the design of the present investigation holds presentation and feedback constant while experimentally manipulating practice in a microteaching environment. Commenting on the state of knowledge concerning microteaching, Cooper and Allen (1971) concluded,

> . . . it is not a cure-all for the problems of teacher education . . . . there is much that is not known about training teachers through this method, just as there is much we do not know about training teachers in a more conventional manner [p. 20].

Chapter III

LABORATORY TRAINING MODELS AND THE NEED FOR RESEARCH

Research findings suggest that teaching skills may be acquired quickly and efficiently in a microteaching setting (McDonald & Allen, 1967, Borg et al., 1969, Davis & Smoot, 1970; Morse & Davis, 1970). Several more recent investigations, however, report that laboratory skill training may not be an effective way for teachers to learn behaviors that are to be employed in the classroom (Copeland & Doyle, 1973; Peterson, 1973). The most satisfactory criterion that can be used in an evaluation of laboratory training programs must be their capacity for providing student teachers with a range of teaching behaviors that may be used in the classroom. The results of the latter two studies seriously question the efficacy of repetitive practice of skills in a microteaching setting as a means for developing classroom skills. The methodological consequences resulting from two assumptions, frequently made by professionals using microteaching, make it very probably that student teachers practising skills in the laboratory setting will be unable to implement those skills in the classroom. These two assumptions are: (1) that the laboratory training model developed at Stanford University is theoretically sound and, therefore, is the appropriate laboratory training paradigm for student teachers wishing to improve their classroom skills, and (2) that an arbitrarily decided number of microteaching lessons will provide adequate practice for a student wishing to incorporate a teaching skill into his behavioral repertoire.

The Relevance of Learning Theory

The laboratory training model developed at Stanford University, as described by McDonald & Allen (1969), and implied by the designs of various published research articles (Orme, 1966; Berliner, 1969; Claus, 1969), consists of a series of microteaching lessons taught over a relatively brief period of time. Each lesson, within this massed practice format, is usually five minutes in length and taught to four or five pupils. A supervisor and recording videotape equipment is also present. Several researchers (e.g. Meier, 1968; Perlberg, 1969) have affirmed the theoretical soundness of this model. While the author is in agreement with the assumption that the model appears theoretically sound when used to train students in teaching skills for use in a specific microteaching environment, he questions whether the paradigm is theoretically sound for training teachers in skills to be used in the regular classroom. Learning theory indicates that repetitive practice in a single environment, beyond the point at which a behavior improves, is likely to result in learning being confined to that specific environment. The principle of learning theory, most relevant to our discussion, is taken from Logan's (1970) chapter on generalization, discrimination and differentiation (pp. 128-133).

The Principle of Generalization

To some degree, learning is confined to both the practice environment and the learned behaviors; in this study, the stimulus situation and learned responses would be the microteaching room and teaching skills respectively. Learning, however, is not totally restricted to the original stimuli and responses. Logan presents the principle of

generalization as one of the most basic principles of learned behavior:

> Whenever a response has been learned in one stimulus situation, similar stimulus situations will also tend to elicit that response in proportion to their similarity, and that stimulus situation will also tend to elicit similar responses in proportion to their similarity [p. 128].

One aspect of this principle, "stimulus generalization," asserts that the more similar an environment is to that in which practice was conducted, the more likely that the learned behavior will occur. A second aspect of the principle, "response generalization," affirms that whenever the learned behavior itself is prevented from occurring, responses similar to those that were practised will tend to be emitted. It needs to be emphasized that "both aspects of this principle apply to all learned habits whether they be acquired through the process of classical, operant or instrumental conditioning" (Logan, p. 129).

Factors Which Increase Generalization

During practice, variation in the stimulus setting, the response emitted and reinforcement will increase the degree to which learning will generalize. The range of stimuli capable of emitting a learned response varies according to the number of stimuli to which the learned response was originally associated. The more numerous the variations in a learned response during practice, the wider the range of behaviors acquired. Finally, a response learned under conditions of variable reinforcement is more likely to generalize extensively than one conditioned by constant reward.

Factors Which Decrease Generalization

Two features of the training conditions which may reduce the degree

of generalization are the amount of reward and extended training. The larger the amount of reward delivered during the acquisition of a behavior the less likely is that response to generalize to a new stimulus situation. Extending rewarded training beyond the point at which a behavior improves results in less generalization (Logan, 1970, pp. 128-133).

The factors influencing the increase and decrease of generalization of learned behavior, which have been described previously, possess important implications for the training of teachers in skills in the microteaching setting. To increase the probability of a teaching skill being used in the classroom, reinforcement during feedback sessions on microteaching lessons should be periodically administered in small amounts. Furthermore, once there is no further improvement of the learned response, training in the original microteaching setting should cease. Beyond this point, to enhance the transfer potential of a learned response, the stimulus situation in which the original learning occurred needs to be changed. The variable elements of the microteaching setting, number of pupils, length of lesson and subject matter need to be changed systematically for additional training sessions so that the disparity between the microteaching and classroom environments is reduced. While gradually increasing the number of pupils taught and the length of each session, the content of the lessons could range over the majority of school subjects. The number and character of these environmental changes necessary to produce effective transfer of teaching skills from the initial microteaching environment to the regular classroom, however, will be consigned to conjecture until experimental investigations determine the answers to these problems.

Varied use of a practised teaching skill during training will also foster transfer of the learned behavior to the classroom. Variability of response during consecutive practice sessions could be increased by systematically changing the requirements made of the teachers. For example, teachers practising the skill of asking high level questions might initially use stems of high level questions to familiarize themselves with the teaching skill. Secondly, with increased confidence, teachers could practise using questions classified according to each of the cognitive domains outlined by Bloom (1956). Finally, with several practice sessions completed, teachers might concern themselves with the most effective methods for sequencing questions when teaching children.

Based on the discussion of learning theory above, it seems reasonable to conclude that the Stanford laboratory training model used by researchers and teacher training institutions, contrary to popular belief, is not theoretically sound when applied to the task of training students in skills to be used in the classroom.

Practice and the Acquisition of Teaching Skills

A second assumption underlying training programs and research studies, which implement or investigate microteaching, is that the number of practice sessions necessary for a student teacher to learn a skill may be arbitrarily decided. The pragmatic consequence of this assumption has been that students are exposed to a minimum number of practice sessions. The number of microteach lessons taught is usually two (Allen, 1967; Borg et al., 1969) but very occasionally the sessions may increase to six (Copeland & Doyle, 1973). Evidence from

both dialectical and empirical sources suggests that for a student teacher to acquire permanently a demonstrated behavioral skill, he must be prepared to participate in 'extended practice.' Taba (1966) stressed that ". . . internalizing a change in fundamental orientation toward teaching and teaching skills is a lengthy process . . ." (p. 200). Meier (1966) suggested the need to overlearn new strategies to avoid a regression to less effective but more easily implemented teaching behaviors when confronted with the anxiety-producing situation of the regular classroom. The characteristics of the proposed phases involved in the learning of psycho-motor skills (Fitts, 1962) lend some support to the assertions made by Taba & Meier.

Fitts suggests, on the basis of empirical evidence, that the learning of complex skills progresses through three phases which he terms 'cognition,' 'fixation' and 'automation.' The progression from one phase to the other is a continuous rather than discontinuous process. There is much evidence to suggest that cognitive processes are utilized considerably during the "cognitive" phase. Verbal interaction between the student and supervisor centers on the analysis of the task, description of the procedures and feedback on errors. This phase may last for several hours or days. The "fixation" phase is characterized by repeated patterns of behavior with little likelihood of inappropriate responses. Depending upon the complexity of the task, this phase may last for weeks or months. The "automation" phase witnesses an increase in both the speed of performance and resistance to stress and interference from concurrent activities (Fitts, 1962, pp. 186-189). It seems intuitively plausible to suggest that the learning of complex verbal, teaching skills

would progress through similar stages, though the amount of time spent in each stage might not correspond to the periods proposed by Fitts for psycho-motor skills. Whatever the eventual amount of practice necessary for the permanent acquisition of each teaching skill, many complex skills of necessity would require considerably longer training than that assumed by Borg et al. (1969) and Copeland & Doyle (1973).

Theory and empirical evidence suggest that students, who wish to extend the range of their classroom skills by participating in laboratory training, will need to teach lessons in an as yet undetermined number of laboratory settings. Learning theory also suggests that students and supervisors will need to be aware of the optimal number of practice lessons that should be taught in each of these successive, environmentally altered, training situations. Access to this information is essential, since extended training in a single environment will ". . . progressively [increase] the specificity of the learning to the particular stimuli and responses practiced" (Logan, 1970). In other words, the more a specific teaching skill is overlearned in a particular laboratory environment, the less will be its potential for transfer to the classroom. A review of the relevant literature, however, reveals that very little replicated, experimental evidence is available to permit one to determine the number of practice lessons a student will need to complete, before acquiring a particular skill for use in the initial laboratory training environment. Since the publication of the research conducted at Stanford University on that institution's laboratory training model, the majority of studies in the area of microteaching have been concerned with the effectiveness of laboratory training paradigms which use microteaching

lessons for students to practice teaching skills. There has been little, if any, systematic experimental analysis of more successful procedures for using microteaching to train students in the use of classroom skills. It is suggested that until such research is conducted, the most effective use of microteaching for the training of teachers may be overlooked. It is the purpose of this thesis, therefore, to determine experimentally the approximate number of microteach lessons with feedback that a sample of student teachers will need to teach before acquiring specific teaching skills for use in a five minute discussion lesson involving five fourth grade pupils. Once this figure has been clarified with replicated results, researchers of microteaching will be able to make a more objective decision as to when the variable elements within the initial laboratory training environment should be altered. Additional research will then be necessary to determine not only the nature and frequency of the proceeding training environments but also the optimal number of lessons that students should teach in each of these settings to ensure that the acquired skills may be used in a regular classroom.

Chapter IV

THE SKILL OF QUESTIONING

I keep six honest serving-men
(They taught me all I Knew);
Their names are What and Why and When
And How and Where and Who.
I send them over land and sea,
I send them east and west;
But after they have worked for me,
I give them all a rest.

. . . . . .

But different folk have different views;
I know a person small —
She keeps ten million serving-men,
Who get no rest at all!
She sends 'em abroad on her own affairs,
From the second she opens her eyes —
One million Hows, two million Wheres,
And seven million Whys!

Rudyard Kipling

The Role of Questioning in Teaching

Professional educational thought, for many years now, has emphasized the need for the development of school children's skill in creative and critical thinking (Ascher, 1961; Hullfish & Smith, 1961). Piaget in summarizing the purposes of education, provided a discerning rationale for the above, proposed instructional goal for school programs:

> The principal goal of education is to create men who are capable of doing new things, not simply of repeating what other generations have done — men who are creative, inventive, and discoverers. The second goal of education is to form minds which can be critical, can verify, and not accept everything they are offered. The great danger today is of slogans, collective opinions, ready made trends of thought. We have to be able to resist individually, to criticize, to distinguish between what is proven and what is not. So we need pupils who are active, who learn early to find out by themselves, partly by their own

> spontaneous activity and partly through material we set up for them; who learn early to tell what is verifiable and what is simply the first idea to come to them. (Quoted in Ripple & Rockcastle, 1964, p. 5).

More recently, however, Crutchfield (1972) laments the failure of the school system to fulfil these preferable educational objectives:

> In pursuit of this aim, traditional schoolwork has concentrated mostly upon the simplest of [cognitive] skills, those concerned with the sheer acquisition of subject matter. Relatively neglected and often ignored, have been the higher level skills of productive thinking and problem solving (p. 189).

Dialectical material, during the past sixty years, has stressed the importance of teacher proficiency in the use of questions and questioning strategies (De Garno, 1911; Loughlin, 1961; Zaborick, 1971). More recently, experimental evidence suggests that children's high level cognitive skills may be developed through the teacher's use of high level questions (Cole & Williamson, 1973). Cole and Williamson divided teacher questions and pupil responses into three categories: (1) Cognitive memory, (2) Convergent thinking, and (3) Divergent and evaluative thinking. Using teachers and students selected from grades two through six, they found evidence to suggest that the cognitive level, length and syntax of pupil responses are "highly contingent" upon the cognitive level of teacher questions. Though, at present, no causal relationship between level of teacher question and level of student response has been established, it seems probable that teacher use of high level questions will help to facilitate student use of the high level skills of productive thinking and problem solving.

While a multiplicity of studies indicate the frequent use of questions by teachers during lessons (Stevens, 1912; Floyd, 1960;

Moyer, 1966; Schreiber, 1967), additional investigations point to the disproportionate use of low level questions (Stevens, 1912; Haynes, 1935; Cory, 1940; Gallagher, 1965; Davis & Tinsley, 1967) and inordinate amount of teacher talk (Stevens, 1912; Briggs, 1935; Corey, 1940; Floyd, 1960). Gall's (1970) review of teacher use of questions indicates that over the last half-century there has been no essential change in the types of question which teachers emphasize in the classroom. Only twenty per cent of teachers' questions provide an opportunity for students to think. Approximately sixty per cent require students to recall facts and the remaining twenty per cent are procedural. Despite the existence of methodological weaknesses in several of the reported studies, the findings of the reviewed investigations are sufficiently consistent to permit the preceding generalization. A study by Davis and Tinsley (1967) suggests that the majority of questions asked by student teachers also focus upon factual recall. At the high school level, more than half the questions asked by social studies student teachers "were judged to test students' recall of facts."

Empirical evidence also suggests that teachers spend an inordinate amount of time talking during lessons, thereby depriving students of the opportunity for frequent interaction. Stevens (1912) found that New York City high school teachers talked approximately two-thirds of the time during a lesson. Floyd (1960) tape-recorded sixty-minute lessons in thirty elementary classrooms. A word count of teacher and pupil talk revealed that the teacher monopolized seventy-one per cent of the total words recorded. Thus, it seems that pupils may be deprived of the opportunity to develop their high level skills of productive

thinking and problem solving, not only because teachers lack expertise in being able to systematically ask high level questions, but also because teachers appear to allow little time for teacher-pupil interaction during the average lesson.

It is apparent, therefore, that scope exists in the proposed training program for training student teachers in the use of high level questions and instructional methods which will increase teacher-student interaction. The present investigation instructed student teachers in the use of two teaching skills: (a) asking high level questions, and (b) redirection—directing the same question to several pupils. Student teachers trained in the first skill, once capable of systematic placement of each high level question, will have the potential to nurture the productive thinking and problem solving skills of elementary school pupils. Ability to use the skill of redirection, while ensuring an increase in the proportion of student talk within a lesson, should also influence many pupils during a lesson, rather than one or two, to use creative and critical thought.

Several studies have attempted to change student teacher questioning habits by some form of training. Berliner (1969) found that student teachers enrolled in secondary education could be trained to use a higher percentage of high level questions through the use of perceptual or written models and various practice conditions. Borg et al. (1969) used a training paradigm similar to that employed in the present investigation to train student teachers in a number of behaviors, one of which was the skill of redirecting questions to elementary school pupils. They report that while each experimental group made "some improvement" in redirection,

change in behavior was statistically significant for two of the four groups. These studies suggest that high level questioning and redirection are trainable skills.

The Acquisition of Questioning Skills in a Microteaching Environment

There is little research to which one may refer in order to determine objectively the number of five minute microteaching lessons with feedback and involving five elementary school pupils, that student teachers need to teach before they acquire the skills of asking and redirecting high level questions for use in that specific training environment. Studies by Borg eg al. (1969) and Berliner (1969) differed not only in the type of student teacher trained but also in method of presenting teaching skills, definition of the microteaching environment in which students practised teaching skills and feedback procedures. The noticeable lack of replicated evidence should dissuade a researcher from formulating specific conclusions about the effects of practice within a particular microteaching environment.

Borg et al. (1969) used student teachers enrolled in elementary education in a study which, along with a series of ten additional behaviors, required the students to practise the teaching skills of asking questions that require the pupil to use higher cognitive processes and redirecting questions. Two experimental groups ($N_1 = 16$; $N_2 = 15$) observed both a filmed introduction to the skills and a model film in which a teacher demonstrated only exemplars of the behaviors in a microteaching situation. The two skills were modeled in conjunction with a third skill, asking questions that call for a set of related

facts. Following an undesignated period of time, the subjects practised the skills of redirection and asking high level questions during two microteaching discussion lessons.

The student teachers' lessons involved four to eight pupils and lasted five to ten minutes. The feedback sessions consisted of each student twice reviewing each lesson alone with an observation form which focused his attention on the three skills just practised. The time lapse between each lesson was not mentioned. The dependent variable was the subject's observed change in behavior on two fifteen-minute videotapes recorded in a classroom with the student's entire class. One tape was recorded before, the other following the experimental treatment. Of the two groups referred to above, one improved significantly in the skill of redirection while the other made a positive but nonsignificant change in this behavior. No significant gain in the use of high level questions for either group was recorded.

Control for grade level of school pupils is not mentioned in the Borg study referred to here. Children's reasoning abilities, between the ages of five and twelve, are continually maturing. Mager (1960) found that adequate explanations of a phenomenon by school age children become more common with an increase in age. Ervin (1960) reports that few grade two and three children were able to discover the principles governing the flexibility of a rod. Reasons for immature patterns of thinking by younger children have included: an undue dependence on perceptual data, a tendency to focus upon only one significant aspect of a complex stimulus situation (Piaget, 1945), and limitations of immediate memory or of attention (McLaughlin, 1963). Faced with

illogical thought patterns and limited memory ability, teachers of lower grades may experience more difficulty in attempting to constantly and systematically stimulate children with high level questions. It is possible that the extraneous influence of grade level, to some unknown degree, depressed the pre- and post-treatment performance scores for teachers of lower grades. It is not possible, therefore, for one to be certain about the reasons for the statistically insignificant change in the skill of framing high level questions within each group; insufficient opportunity to practise the skill, the confounding influence of grade level taught, or a combination of these methodological inadequacies, are each valid reasons which may be advanced as explanations for the unexpected result.

Berliner (1969) used high level questions as the dependent variable in a study involving student teachers enrolled in secondary education. Berliner was investigating, experimentally, the effects of systematically varying the method of presentation and practice conditions. The results pertaining to one experimental group (n = 8) possess some tentative implications for the present study. Prior to a laboratory practice lesson, these subjects were exposed twice to a perceptual model of the skill (exemplars only) and concomitantly cued with comments recorded on an audiotape. The content of each of the three microteaching lessons used to train the student teachers was of their own choice, lasted five minutes and involved four pupils of the same grade level. Feedback immediately followed each lesson and comments recorded on an audiotape were used to direct attention to the form of question asked. The entire training sequence was completed in one hour and twenty minutes on the

same day. The experimental group (i.e. No. 5) manifested a statistically significant increase in high level questions, from nineteen per cent to fifty-one per cent over the three microteaching lessons.

Variability between the two reviewed studies on many significant variables precludes a meaningful comparison of their results. Some of these important variables were: the type of student teacher trained, number of teaching skills modeled, frequency with which these skills were presented to the students during training, length of microteaching lessons, number and grade level of school pupils involved in each lesson, subject taught by student teachers and feedback procedures. The fact that the review of the 1969 studies by Borg et al. and by Berliner directs one's attention to only general and very tentative suggestions concerning the effects of practice on the acquisition of specific teaching skills in a particular microteaching environment precludes the delineation of directional hypotheses for this thesis. Borg et al. (1969) suggest that the skill of redirection may be acquired quickly. That students needed to teach only two microteaching lessons before being able to improve their use of redirection in the regular classroom suggests that this skill may be acquired for use in a specific microteaching setting during four practice lessons. Berliner's (1969) investigation suggests that the skill of asking high level questions also may be acquired, for use in a particular microteaching environment, by student teachers of secondary school pupils, during four practice lessons. Because they teach younger pupils, student teachers enrolled in elementary education may require additional practice lessons before acquiring the skill of asking high level questions.

A distributed rather than massed practice design, however, may compensate for this hypothesized restraining influence upon the student teachers' rate of learning. By making more time available for lesson preparation, a training program which incorporated distributed practice should assist the teacher of elementary school pupils to thoroughly plan his/her questions to ensure that each lesson's questions will cue the pupils adequately and evoke the desired level of response. Finally, since the skill of asking high level questions is to be used in this thesis, the review of the study by Borg et al. (1969) suggests that the grade level of the school pupils involved in microteaching lessons needs to be controlled.

Chapter V

HYPOTHESES

The hypotheses for the present study were drafted with the intention that the investigation provide answers to three questions: (a) Did the entering behavior of the experimental and control groups for each questioning skill differ significantly? (b) Did the experimental treatment significantly improve subject performance in both teaching skills? (c) What is the approximate number of lessons that the subjects must teach in a specific microteaching environment before they acquire each questioning skill for use in that practice setting?

The hypotheses investigated through the present study were:

Within Group Comparisons

1. For each experimental and control group, there will be no significant difference between pre- and post-test mean scores for the skills of (a) redirection and (b) asking questions that require pupils to use higher cognitive processes.

Between Group Comparisons

2. The mean performance pre-test scores of each group of subjects, for the skills of (a) redirection and (b) asking questions that require pupils to use higher cognitive processes, will not differ significantly.

3. The mean performance change scores of each experimental group, for the skills of (a) redirection and (b) asking questions that require pupils to use higher cognitive processes, will not differ significantly.

Chapter VI

EXPERIMENTAL PROCEDURE AND DESIGN

Description of The Sample

The experimental subjects were twenty-seven pre-service, fourth year B.Ed. students enrolled in a special full-year course which comprised two practice-teaching sessions and a series of separate instructional sequences each offered by a Professor from one of four departments: Educational Psychology, Educational Foundations, Elementary Education and Educational Administration.[1] The subjects were permitted to select one of five schools in which they would fulfil their six week practice teaching requirements during the months of February and March, 1975. To acquaint subjects with the concept of microteaching, each student practised the skill of reinforcement in two microteaching lessons, during the first practice teaching session in November, 1974. Each of the five groups of subjects was assigned randomly to either a treatment or control group. Since the subjects were not selected randomly, the χ^2 test for k-independent samples (Siegal, 1956, p. 175) was used to test for significant differences between groups on potentially confounding variables (Table I). The groups were found to differ significantly on only one variable, level of supporting income.

Study Procedure

Independent variable. Practice, in the form of microteaching lessons, was the experimentally manipulated variable.

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[1]Additional classes, related to each student's subject area and quite separate from the core course, were also attended by the student teachers.

TABLE I

Comparison of Five Groups on Potentially Confounding Sociological and Descriptive Variables

	Variable	χ^2 *Probability*
1.	Age range: 20—27	N.S.*
2.	Sex	N.S.
3.	Number of younger brothers and sisters	N.S.
4.	Marital status	N.S.
5.	Residence (at home or away from home)	N.S.
6.	Level of supporting income (if living at home, father's income was used).	<.05> .02
7.	Grade point average	N.S.
8.	Total weeks of practice teaching	N.S.
9.	Total weeks practice teaching: fourth grade	N.S.

*Not significant at .05 level.

Dependent variable

The dependent variable, recorded on two five minute video tapes, was each subject's performance in the teaching skills, redirection and asking questions that require a pupil to use higher cognitive processes. One lesson was recorded prior to, the other following, the experimental treatment.

Entering behavior

Twenty-seven student teachers were pre-tested during the first week of practice teaching, in a microteaching lesson which consisted of a five minute discussion involving five grade four pupils. No specific instructions to guide their teaching behaviors were circulated.

Instructional procedures

The questioning skills developed by Borg et al. (1970*a*) were taught by means of a filmed presentation. The skills were described in an instructional lesson which included illustrative film clips showing teachers using the desired questioning behaviors. A handbook was given to each subject describing the rationale (Borg et al. 1970*b*, pp. 47-57). Immediately following the instructional film, the subjects were exposed to a second film in which a model teacher illustrated the questioning skills (exemplars only) in a microteaching situation. Subjects were required to identify the occurrence of each skill on a check list (Borg et al., 1970*b*, p. 58). In a replay of the model film the subjects were given an opportunity for checking their responses. The subjects were then instructed to prepare a microteaching lesson in which each could practise the skills described in the instructional and model films. Each group of subjects was exposed to the films the day preceding their first

microteaching lesson.

Microteaching

Each videotaped microteach lesson consisted of a five minute discussion involving five grade four pupils. Groups of pupils were rotated so that subjects did not teach the same group twice.

Feedback

Feedback consisted of each subject immediately reviewing the lesson on videotape. While self-assessment (skill rating forms were used by each subject [Borg et al., 1970*b*, pp. 62 and 64]), constituted a major portion of the thirty minute feedback session, the experimenter-trainer, following the first lesson, assisted each subject in identifying the teaching skills. A structured verbal guideline suggesting how students might use high level questions to teach a concept was provided during each feedback session. Subjects did not receive feedback on their final microteaching lesson.

Experimental and control groups

The three experimental groups differed in the number of microteach lessons taught after viewing the instructional films. The interval between each lesson was twenty-four hours.

E_1 - taught two microteach lessons n = 4

E_2 - taught three microteach lessons n = 6

E_3 - taught four microteach lessons n = 6

Groups C_1 and C_2 controlled for the possible confounding influence of time and practice teaching.

C_1 - Control for time. Subjects received a training schedule identical to E_1 except that the interval between lessons was forty-eight hours. n = 6

C_2 - Control for practice teaching. Subjects viewed instructional films but did not teach practice lessons. n = 6

Final assessment

The post-test for the groups E_1, E_2, E_3, and C_1, consisted of the final microteaching lesson. At the conclusion of six weeks, when these four groups had taught their final microteaching lesson, the subjects of C_2 were post-tested.

Quantification of data

Two raters independently analyzed the pre- and post-test tapes for each subject and obtained a frequency score for the questioning skills of redirection and asking questions that require pupils to use higher cognitive processes. Protocols for each student teacher were compared after each five-minute lesson was coded by the experimenter and a person unfamiliar with the amount of training each group received. In cases of dispute, the tape was reanalyzed. Inter-rater reliability was calculated on the basis of six five-minute sequences and was .91 for the skill of redirection and .95 for the skill of asking high level questions. For this study, it was decided to obtain a skill frequency score for each subject rather than a functional analysis of his/her teaching behavior. Though the latter type of analysis is undoubtedly important, it is reasoned that student teachers must first be able to perform a particular teaching skill before concerning themselves with such essential, but initially distracting problems as, the correct placement of a high level question, or, whether or not redirected questions involved volunteers or non-volunteers.

(i) Teacher questions were divided into two categories (Appendix A):

(a) Questions that require recall of factual information by the pupil (low level questions).

(b) Questions that require the pupil to use or manipulate this factual information in some way (high level questions).

Since frequency of teacher questions varies in each lesson, it was necessary to convert lesson totals for each type of question to a figure which would be comparable with similar totals for additional lessons, including those of other teachers. To facilitate comparison between lessons, therefore, scores for each type of question were converted to a percentage of the total number of questions asked.

(ii) Redirection occurred when a single question was directed to more than one student (Appendix B).

(iii) Mean difference scores were used in the study to compare the performances of the experimental and control groups. Claus (1969) summarized professional educational thought on the issue of change scores:

> The unreliability of change scores has been discussed by Lord (1963) who cites two major sources of confusion in studies of change: errors of measurement and regression effects (see also Bereiter, 1963, and Webster & Bereiter, 1963). If two measurements are highly positively correlated, their difference has a smaller variance than if they were independently related. This variance, however, is almost all error and it is in this sense that a difference score is unreliable. Also, any *one* change score is unreliable due to regression toward the mean of the group. It is therefore difficult to estimate true change for each subject from individual observed change scores. However, where effects of separate treatments are to be compared, estimates of group mean changes can be used. Lord (1963, p. 37) cautions, however, that "analysis of observed gains results in a built-in bias in favor of whatever treatments happen to be assigned to initially low-scoring groups" (Claus, 1969, p. 21).

To determine the approximate number of lessons necessary for the acquisition of each questioning skill, in a specific microteaching environment, the mean performance change score of each group for each skill was

compared. Provided that the experimental groups' performances differed significantly from the performance of the control, C_2, it was assumed that a statistically nonsignificant difference in mean behavior improvement scores between two experimental groups indicated the point at which a skill had been acquired for use in that particular environment.

Experimental Design

The *t*-test was used to test for significant differences within each of the five groups while an analysis of variance was performed to test for significant differences between the groups. Parametric tests were selected as ". . . these tests are the most likely of all tests to reject H_0 when H_0 is false" (Siegal, 1956, p. 19). Of the five assumptions underlying the analysis of variance model and the four that underlie the *t*-test, only two assumptions common to both statistical techniques may not have been satisfied completely. These two assumptions are:

Assumption 1: . . . the distribution of the dependent variable in the population from which the samples are drawn is normal (Ferguson, 1971, p. 219).

Assumption 2: . . . the observations must be independent (Siegal, 1956, p. 19).

Though the small n's of each group prevent a rigorous demonstration of a lack of normality in the data (Assumption 1), there is little reason to suspect an extreme departure from normality. Glass et al. (1972, pp. 246-255) reviewed studies which have examined the effects of violating the assumption of normality. Their investigation indicates that reasonable departures from the assumption of normality for the two tailed *t*- and F-tests may occur without seriously affecting the validity of the

inferences drawn from the data. With regard to the second assumption, Table I suggests that the subjects used in the present investigation may not have been significantly dissimilar from a randomly selected group of students.

The Newman—Keuls procedure (Winer, 1962, p. 80) was used to test the significance of differences of means between groups after a significant overall F.

A Chi-square test (ANOVA 15) developed by the Department of Educational Research, University of Alberta, was used to test the hypothesis:

$$\delta_1^2 = \delta_2^2 = \delta_k^2$$

for the groups' mean pre-treatment and mean performance change scores for two questioning skills.

The "difference method" (Ferguson, 1971, p. 153) was the procedure selected to test the significance of the differences between the mean pre- and post-treatment scores within each of the five groups via the statistic:

$$t = \frac{\Sigma D}{\sqrt{[N\Sigma D^2 - (\Sigma D)^2] / (N-1)}}$$

The parameter associated with this distribution is N-1, the degree of freedom.

The Hartley test for homogeneity of variance was performed to test the hypothesis:

$$\delta_1^2 \quad \delta_2^2$$

for each group's mean pre- and post-treatment performance scores for two

questioning skills via the statistic:

$$F_{max} = \frac{\text{largest of k treatment variances}}{\text{smallest of k treatment variances}} .$$

The parameters associated with this distribution are k, the number of treatments, and n-1, the degree of freedom for each treatment variance (Winer, 1962, p. 93).

Chapter VII

ANALYSIS OF THE DATA

The following chapter consists of three sections. Part I presents the results of the between group comparisons of the mean pre-treatment performance scores for two questioning skills using a one-way analysis of variance. Part II presents the results of the within group *t*-tests of significance between mean pre- and post-treatment performance scores and the interaction effects between two questioning skills. Part III presents the results of the between group comparisons of the mean performance change scores for two questioning skills using a one-way analysis of variance.

PART I

Between Group Comparisons of Mean Pre-treatment Performance Scores for Two Questioning Skills

Tests for homogeneity of variance in mean pre-treatment skill scores

The Chi-square test for homogeneity of variance was performed on the variances obtained on the mean pre-treatment skill scores. The variances for each group's scores, on the skills of redirection and asking questions that require pupils to use higher cognitive processes, are presented in Table II. The calculated Chi-square values for the variances associated with pre-treatment mean scores on the skills of redirection and framing questions that require pupils to use higher mental processes were 1.76 (probability = 0.78) and 3.95 (probability

TABLE II

Variances for Mean Pre-treatment Skill Score

Group	*N*	*Redirection*	*High Level Questions*
C_2	6	32.57	368.65
C_1	5	17.50	106.81
E_1	4	8.25	53.52
E_2	6	23.87	110.45
E_3	6	14.67	235.48

=0.41) respectively. These Chi-square values are not significant at the .05 level of significance, substantiating the assumption of homogeneity of variance among mean pre-treatment performance scores for the two questioning skills.

Tests for significant difference of means for pre-treatment performance scores on each of two questioning skills

Mean and standard deviations for the performance scores of the five groups on the questioning skills of redirection and asking questions that require pupils to use higher cognitive processes are presented in Tables III and IV.

The analyses of variance for the mean performance scores on each skill are summarized in Tables V and VI. No significant differences were found among the five group scores, on either of the questioning skills, at the .05 level of significance. As neither F-ratio attained significance, testing of differences between pairs of means was not performed.

PART II

Within Group Comparisons of Mean Pre- and Post-treatment Performance Scores and Interaction Effects between Two Questioning Skills

Tests for homogeneity of variance in mean pre- and post-treatment skill scores

A Hartley test for homogeneity of variance (Winer, 1962, p. 93) was performed on the variances obtained for the mean pre- and post-treatment skill scores. The variances for each group's scores on the skills of redirection and asking questions that require pupils to use higher

TABLE III

Means and Standard Deviation for Pre-treatment Performance Scores on the Skill of Redirection

Group	*N*	*Mean*	*Standard Deviation*
C_2	6	9.83	5.70
C_1	5	7.00	4.18
E_1	4	5.25	2.87
E_2	6	5.67	4.89
E_3	6	6.78	3.83

TABLE IV

Means and Standard Deviations for Pre-treatment Performance Scores on the Skill of Asking Questions that Require Pupils to Use Higher Cognitive Processes

Group	*N*	*Mean*	*Standard Deviation*
C_2	6	27.37	19.20
C_1	5	18.68	10.33
E_1	4	24.65	7.32
E_2	6	20.37	10.51
E_3	6	20.43	15.35

TABLE V

Summary of Analysis of Variance for Pre-treatment Scores in the Skill of Redirection

Source	*S.S.*	*d.f.*	*M.S.*	*F.*	*P.*
Between Groups	80.41	4	20.10	0.98	0.44
Experimental Error	450.25	22	20.47		
Total	530.66	26			

TABLE VI

Summary of Analysis of Variance for Pre-treatment Scores in the Skill of Asking Questions that Require Pupils to Use Higher Cognitive Processes

Source	*S.S.*	*d.f.*	*M.S.*	*F.*	*P.*
Between Groups	284.95	4	71.24	0.38	0.82
Experimental Error	4160.68	22	189.12		
Total	4445.63	26			

cognitive questions are presented in Table VII.

Appropriate values for each group on each skill were substituted in the following formula:

$$\text{Fmax} = \frac{S^2 \text{ largest}}{S^2 \text{ smallest}}$$

None of the ten calculated Fmax values exceeded the critical value at the .05 level of significance, substantiating the assumption of homogeneity of variance among each group's pre- and post-treatment performance scores on two questioning skills. Parameters, critical values of Fmax and calculated Fmax scores for each set of variances are presented in Table VIII.

Tests for significant difference of means for pre- and post-treatment scores of each group on two questioning skills

Figure 2 and 3 show the mean number of redirections and the mean percentage of high level questions respectively, each as a function of pre- and post-treatment measures and groups. There appears to be a main effect across all groups which shows an increase in each skill from pre- to post-treatment evaluation.

Means for the pre- and post-treatment scores of the five groups on the questioning skills of redirection and asking questions that require pupils to use higher cognitive processes are presented in Table IX.

The two-tailed *t*-tests for pre- and post-treatment mean scores on each skill are summarized in Tables X and XI. Significant differences between mean pre- and post-treatment scores, at the .05 level of significance, on the skill of redirection, were found for the groups C_1 and E_3. With the exception of C_2, each group's mean pre- and post-treatment

TABLE VII

Variances for Each Group's Pre- and Post-treatment Mean Scores on Two Questioning Skills

Group	*Redirection*		*High Level Questions*	
	pre	*post*	*pre*	*post*
C_2	32.57	11.37	368.65	74.51
C_1	17.50	13.50	106.81	451.77
E_1	8.25	12.25	53.52	69.72
E_2	23.87	16.57	110.45	473.63
E_3	14.67	19.10	235.48	274.91

TABLE VIII

Summary of Hartley Tests for Homogeneity of Variance for Each Group's Pre- and Post-treatment Mean Scores on Two Questioning Skills

Group	*k*	*d.f.*	*Critical Value Fmax (.05)*	*Fmax*	*Probability*
			The Skill of Redirection		
C_2	2	5	7.15	2.86	N.S.
C_1	2	4	9.60	1.30	N.S.
E_1	2	3	> 9.60	1.48	N.S.
E_2	2	5	7.15	1.44	N.S.
E_3	2	5	7.15	1.30	N.S.
			The Skill of Asking Questions that Require Pupils to Use Higher Cognitive Processes		
C_2	2	5	7.15	4.95	N.S.
C_1	2	4	9.60	4.23	N.S.
E_1	2	3	> 9.60	1.30	N.S.
E_2	2	5	7.15	4.29	N.S.
E_3	2	5	7.15	1.17	N.S.

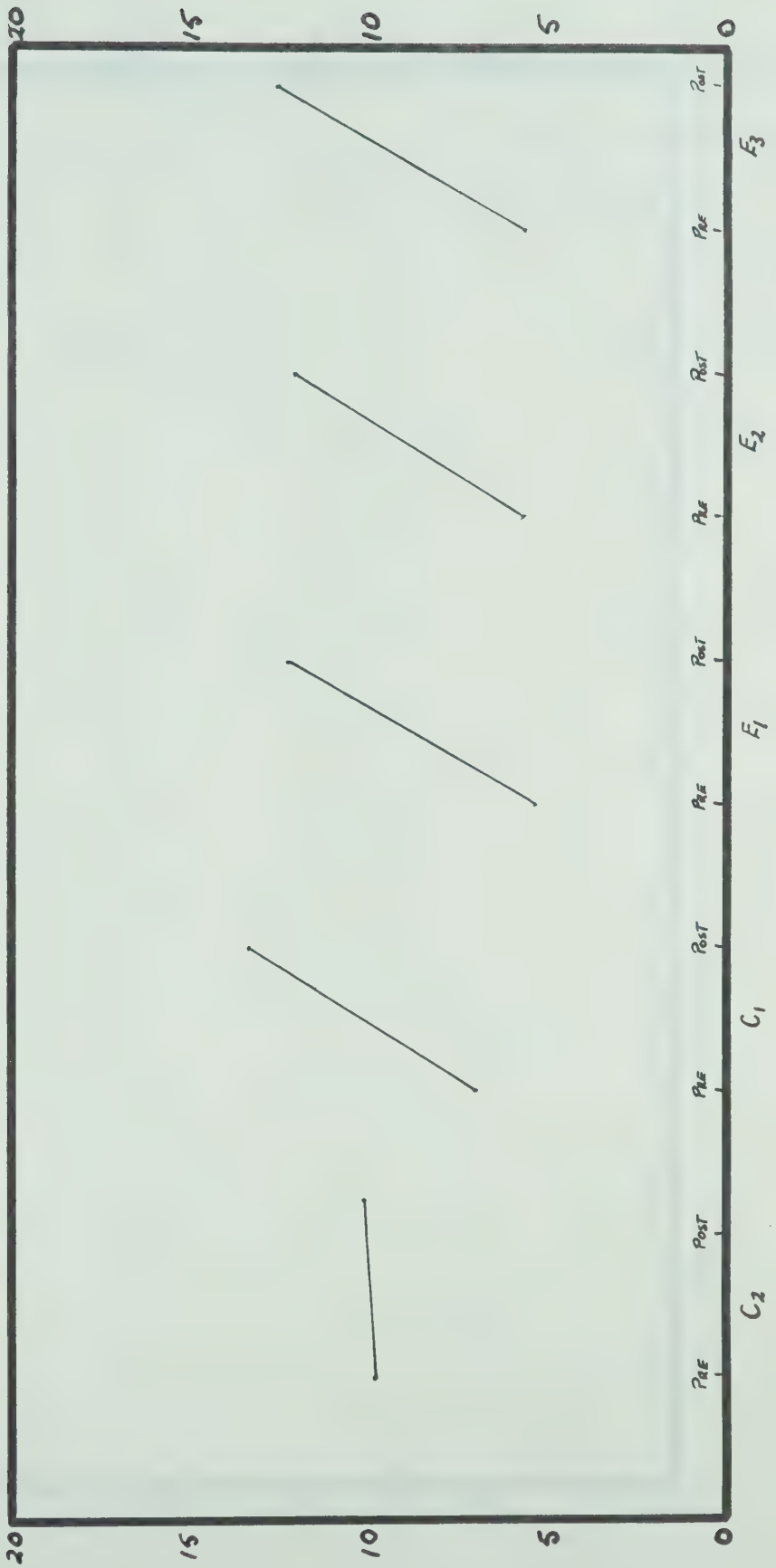

Fig. 2. Mean number of redirections as a function of pre- and post-treatment measures and groups.

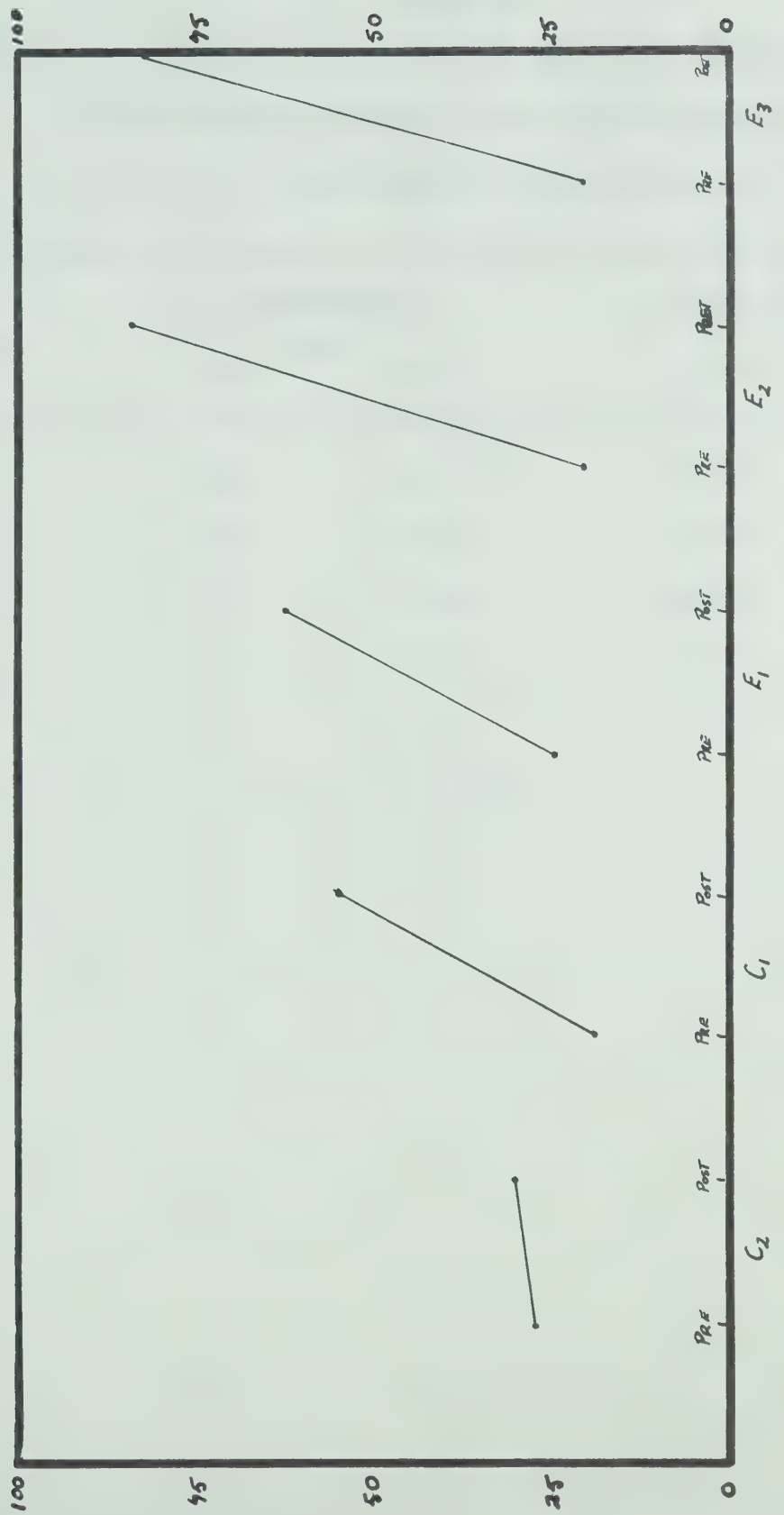

Fig. 3. Mean percentage of high level questions as a function of pre- and post-treatment measures and groups.

TABLE IX

Group Means for Pre- and Post-treatment Scores on the Skills of Redirection and Asking Questions that Require Pupils to Use Higher Cognitive Processes

Group	*Redirection*		*High Level Questions*	
	Means		*Means*	
	pre	*post*	*pre*	*post*
C_2	9.83	10.17	27.37	30.37
C_1	7.00	13.40	18.68	54.94
E_1	5.25	12.25	24.65	62.53
E_2	5.67	12.17	20.37	84.07
E_3	5.67	12.50	20.43	82.37

TABLE X

Within Group *t*-tests of Significance between Pre- and Post-treatment Means for Correlated Samples on the Skill of Redirection

Group	*d.f.*	*Critical t(.05)*	*t.*	*Probability*
C_2	5	2.57	0.14	> .20
C_1	4	2.78	5.93	< .01 > .001
E_1	3	3.18	2.92	< .10 > .05
E_2	5	2.57	2.12	< .10 > .05
E_3	5	2.57	3.59	< .02 > .01

TABLE XI

Within Group *t*-tests of Significance between Pre- and Post-treatment Means for Correlated Samples on the Skill of Asking Questions that Require Pupils to Use Higher Mental Processes

Group	*d.f.*	*Critical t(.05)*	*t.*	*Probability*
C_2	5	2.57	0.37	> .20
C_1	4	2.78	4.49	< .02 > .01
E_1	3	3.18	16.50	< .001
E_2	5	2.57	7.58	< .001
E_3	5	2.57	6.38	< .01 > .001

scores, for the skill of asking questions that require pupils to use higher cognitive processes, differed significantly at the .05 level of significance.

Interaction effect between redirections of high and low categorization and questions that do and do not require students to use higher mental processes

Figure 4 presents an interaction effect between (1) redirection of questions that require pupils to use higher mental processes (high redirections) and redirection of questions that do not require pupils to use higher cognitive processes (low redirections), and (2) questions that require pupils to use higher mental processes and those that do not require pupils to use this level of processing information. For each group, the proportion of high redirections and high level questions increases between pre- and post-treatment measures while the proportion of low redirections and low level questions decreases. The graph's ordinate represents the probability of response which can be divided into proportion of low and high categories of actual responses. For example, the high and low proportions of redirection in C_2 pre-test are: 0.37 + 0.63. The abscissa is the independent variable (microteaching practice) as experienced by the experimental groups E_1, E_2, E_3 and the control group C_1.

PART III

Between Group Comparisons of Mean Performance Change Scores for Two Questioning Skills

Tests for homogeneity of variance in mean performance change scores

The Chi-square test for homogeneity of variance was performed on the

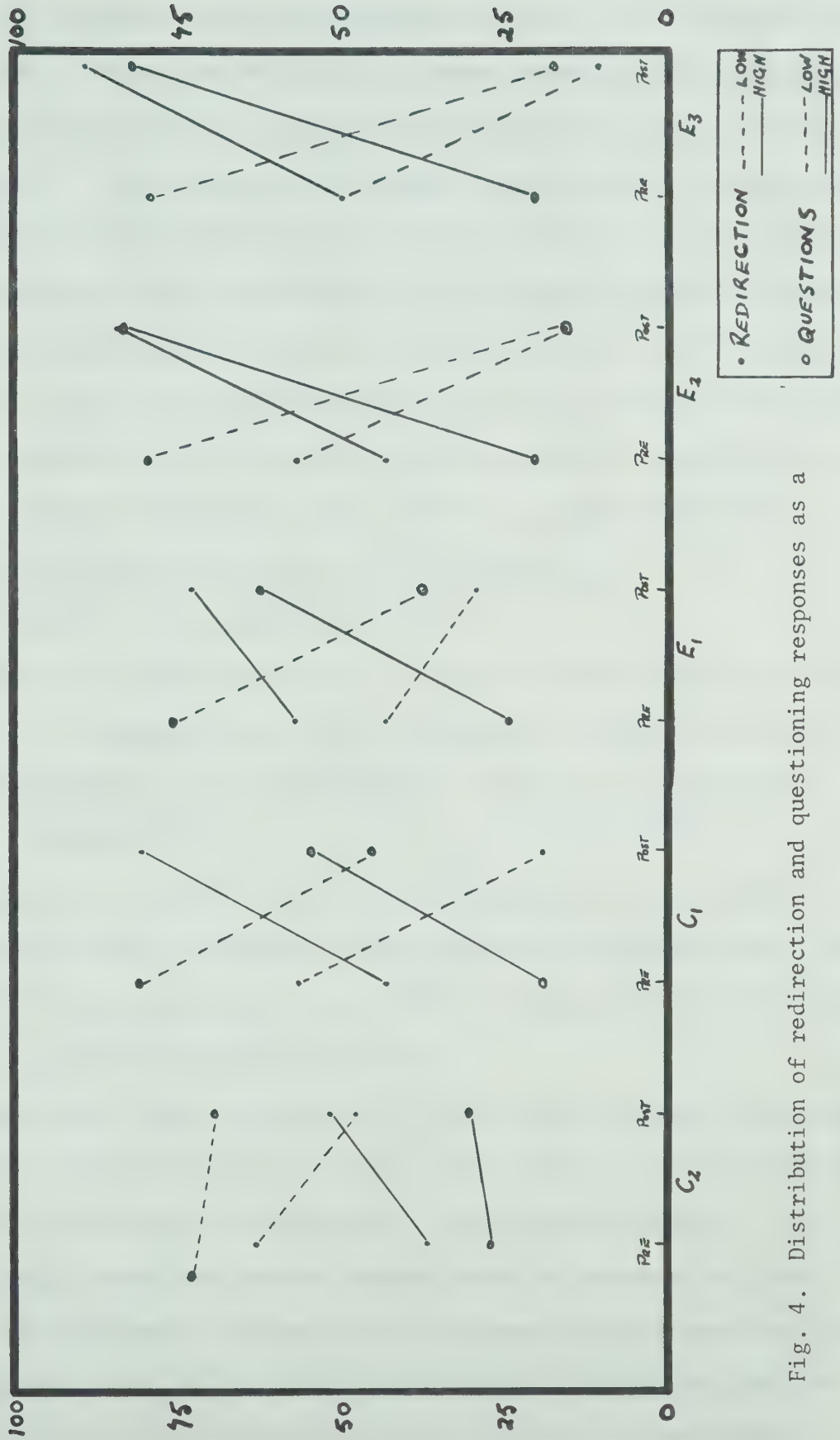

Fig. 4. Distribution of redirection and questioning responses as a function of low and high categorization and group.

variances obtained for the mean difference scores. The variances for each group's scores, on the skills of redirection and asking questions that require pupils to use higher cognitive processes, are presented in Table XII. The calculated Chi-square values for the variances associated with the mean difference scores on the skills of redirection and asking questions that require pupils to use higher cognitive processes were 3.63 (probability = 0.46) and 5.93 (probability = 0.20) respectively. These Chi-square values are not significant at the .05 level of significance, substantiating the assumption of homogeneity of variance among mean performance difference scores for the two questioning skills.

Tests for significant difference of means for change scores on each of two questioning skills

Means and standard deviations for the difference scores of the five groups on the questioning skills of redirection and asking questions that require students to use higher cognitive processes are presented in Tables XIII and XIV.

Analysis of variance for the mean change scores on each skill are summarized in Tables XV and XVI. No significant differences were found among the five group scores on the skill of asking questions that require pupils to use higher cognitive processes.

Since the F ratio associated with the latter skill did attain significance, the Neuman-Keuls procedure (Winer, 1962, p. 80) was used to test the significance of differences of means between groups. The Neuman-Keuls comparison between ordered means is presented in Table XVII. The differences between each of the mean change scores for the experimental groups E_1, E_2 and E_3 and the mean change scores for the control group C_2 was significant at the .05 level of significance.

TABLE XII

Variances for Mean Performance Change Scores

Group	*N*	*Redirection*	*High Level Questions*
C_2	6	34.27	405.20
C_1	5	5.80	324.82
E_1	4	23.33	20.26
E_2	6	56.30	423.01
E_3	6	22.17	565.95

TABLE XIII

Means and Standard Deviations for Change Scores on the Skill of Redirection

Group	*N*	*Mean*	*Standard Deviation*
C_2	6	0.33	5.85
C_1	5	6.40	2.41
E_1	4	7.00	4.83
E_2	6	6.50	7.50
E_3	6	6.83	4.71

TABLE XIV

Means and Standard Deviations for Change Scores on the Skill of Asking Questions that Require Pupils to Use Higher Mental Processes

Group	*N*	*Mean*	*Standard Deviation*
C_2	6	3.00	20.13
C_1	5	36.26	18.02
E_1	4	37.88	4.50
E_2	6	63.70	20.57
E_3	6	61.93	23.79

TABLE XV

Summary of Analysis of Variance for Change Per Cent Scores on the Skill of Redirection

Source	*S.*	*d.f.*	*M.S.*	*F.*	*P.*
Between Groups	188.32	4	47.08	1.58	0.22
Experimental Error	656.87	22	29.86		
Total	845.19	26			

TABLE XVI

Summary of Analysis of Variance for Change Per Cent Scores on the Skill of Asking Questions that Require Pupils to Use Higher Cognitive Processes

Source	*S.S.*	*d.f.*	*M.S.*	*F.*	*P.*
Between Groups	14536.17	4	3634.04	9.60	0.0001
Experimental Error	8330.88	22	378.68		
Total	22867.05	26			

TABLE XVII

Newman-Keuls Comparison Between Ordered Means for the Skill of Asking Questions that Require Pupils to Use Higher Cognitive Processes

		E_2	E_3	E_1	C_1	C_2
	Means	63.70	61.93	37.88	36.26	3.00
C_2	3.00	60.70*	58.93*	34.88*	33.26*	0.0
C_1	36.26	27.44	25.67	1.62	0.0	
E_1	37.88	25.82	24.05	0.0		
E_3	61.93	1.77	0.0			
E_2	63.70	0.0				
R		5	4	3	2	
Critical Significance		36.62	33.33	30.19	24.93	

*Significant at the .05 level.

Chapter VIII

DISCUSSION AND METHODOLOGICAL LIMITATIONS

Summary

The objective of the present study was to determine the amount of practice with feedback that students would require in a particular environment before acquiring specific teaching skills. Specifically, with presentation and feedback constant, subjects practised the skills of asking high level questions and redirection in five minute discussion classes involving five fourth grade pupils to establish the number of microteaching/feedback lessons that would have to be taught to acquire the two skills for use in the training environment.

Twenty-seven fourth year Bachelor of Education students were divided among five schools, each group being randomly assigned to either a treatment or control condition. The following groups were delineated:

E_1 - taught two microteach lessons n = 4

E_2 - taught three microteach lessons n = 6

E_3 - taught four microteach lessons n = 6

The interval between each lesson was twenty-four hours.

C_1 - control for time. Subjects received a training schedule identical to that of E_1, except that the interval between lessons was forty-eight hours. n = 6

C_2 - control for practice teaching. Subjects viewed instructional films but did not teach practice lessons. n = 6

With the exception of the final microteaching lesson, subjects received feedback on their performance immediately following each practice session.

The analysis of the pre-treatment and post-treatment microteaching lessons provided frequency scores for the skill of redirection and per cent scores for the skill of asking high level questions for each student.

The hypotheses of the study were:

Within Group Comparisons

1. For each experimental and control group, there will be no significant difference between pre- and post-test mean scores for the skills of (a) redirection and (b) asking questions that require pupils to use higher cognitive processes.

Between Group Comparisons

2. The mean performance pre-test scores of each experimental and control group of subjects, for the skills of (a) redirection and (b) asking questions that require pupils to use higher cognitive processes, will not differ significantly.

3. The mean performance change scores of each experimental and control group, for the skills of (a) redirection and (b) asking questions that require pupils to use higher cognitive processes, will not differ significantly.

The *t*-test and one-way analysis of variance were performed on the data pertaining to each teaching skill to test for overt differences within and among the groups respectively. While hypotheses two, and three (a) received support in this study, there was insufficient evidence to uphold hypotheses one and three (b) at the 0.05 level of significance.

Discussion of the Results

The results of this study suggest the efficacy of microteaching with feedback as a means for a sample of student teachers to practise the

teaching skills of asking questions that require pupils to use higher cognitive processes and redirection. The students quickly acquired the skill of asking high level questions for use in a particular instructional environment and in conjunction with the skill of redirection were able to reduce considerably the frequency with which questions were asked. This reduction in the number of questions asked, however, appears to have left the students with insufficient opportunity to practise the skill of redirection.

The statistically significant difference between each of the mean change scores for the groups C_1, E_1, E_2, E_3 and the mean change score for the control group C_2 for the skill of asking questions that require students to use higher cognitive processes suggests that this skill may be acquired for use in a five minute microteaching class upon completion of one lesson with feedback. A trend toward a statistically significant difference between the mean change score for the group E_1 and the mean change score for E_3 (Table XVII), however, suggests that the student teachers' acquisition of the skill may benefit from an additional practice-feedback session. It is noticeable that of the twelve students in groups E_2 and E_3 only two failed to increase the proportion of high level questions asked by more than 70%. Furthermore, at the conclusion of the experimental treatment, the proportion of high level questions asked by five students was 100% while the proportion for an additional four students exceeded 74%. Though average per cent scores were used for the purpose of statistical analysis, it seems that the results thus obtained realistically portray the performance of the majority of individual students.

A desired effect of training student teachers in the use of high level questions and redirections was an increase in pupil involvement in a lesson with a concomitant reduction in the proportion of teacher talk. Figure 3 indicates that as the student teachers, in each of the experimental groups, asked more high level questions the proportion of low level questions decreased. In addition, as the number of redirections on high level questions increased, the number of redirections on low level questions decreased. Appendix C indicates the overall effect of these developments. Within each experimental group, a reduction in the frequency of questions was accompanied by an increase in the number of redirections used by teachers.

Training in the use of high level questions and redirection for a sample of student teachers not only appears to have increased student involvement and decreased teacher talk during a discussion level, but also seems to have enriched the quality of the pupil-teacher interaction. While the more frequent use of high level questions required the students to manipulate information, the increased use of redirection also encouraged the pupils to perform a more cognitively active role in a lesson. In most cases of redirection, the student was usually updating and changing his answers depending on the type of information volunteered by his peers. An unfortunate consequence of the considerable reduction in the total number of questions asked by student teachers, however, was the scant opportunity available to practise the skill of redirection.

Though the data suggest that the instructional procedures adopted for this study are both effective and efficient in developing the skill of asking high level questions in a five minute laboratory lesson for a sample

of student teachers (Tables XI, XVI), the results of this study (Tables X, XV) also indicate that concomitant training in the skills of asking high level questions and redirection inhibit the development of the latter skill. A consequence of simultaneously training the student teachers in the skills of asking high level questions and redirection was a considerable reduction in the number of low level questions asked during a five minute microteaching discussion lesson involving five pupils (Appendix D). The substantial reduction in the frequency of low level questions asked by the experimental subjects diminished the students' opportunities to practise the skill of redirecting various types of questions. The resultant effect was manifested in the between-group comparisons of the mean performance change scores for the skill of redirection (Table XV). No experimental group's performance for the skill of redirection differed significantly at the 0.05 level from the control group's (C_2) performance. While it would seem desirable to combine the skills of asking high level questions and redirection into a teaching strategy, the above evidence suggests that, when initially training the student teachers of this study in the use of the two behaviors, each skill should be solely presented and practised with feedback in a microteaching setting.

Methodological Limitations of the Study

Four methods adopted in the experimental procedure of the present study: (i) non-random selection of sample, (ii) classification of questions according to the level of pupil response, (iii) presentation and practice of two teaching skills, and (iv) the combined role of the experimenter as both instructor and evaluator, impose restrictions upon

the degree of confidence one may place in the results of this investigation.

Firstly, though subjects for this study were not randomly selected, χ^2 (Table I) and pre-test (Tables V and VI) data suggest that experimental subjects may not have been significantly dissimilar from a randomly selected group of students. That students did differ significantly on one sociological variable, however, raises the possibility that some undetermined extraneous variable(s) may have confounded the results. Random selection of the sample followed by a test for significant differences between groups on possible confounding variables would help to control this potential cause of systematic bias in experimental results.

Secondly, high level questions in this study were classified according to whether or not a pupil manipulated his knowledge in some manner before responding to a question. An advantage of this procedure was that the desired effect of using high level questions became the focus of student teacher attention. The method of coding, however, presumed that raters knew beforehand what the pupils had learned about the subject under discussion. Despite rater awareness of the content of classroom lessons upon which microteaching discussions were based, there was occasionally no way of being certain that a child in answering a question had either simply reproduced information or inferred his answer from stored knowledge. Under these conditions a rater sometimes experienced difficulty in accurately classifying questions. Though the coding system proved sufficiently accurate for the purposes of this thesis, future studies which require the classification of questions into high and low categories might consider an alternative method of coding. In the

alternative system of coding both the teacher's question and the pupil's answer, subdivided according to Bloom's categories of thinking, might be used as the criteria for determining the cognitive level of a question.

Thirdly, combined presentation of teaching skills is not the most effective method for ascertaining the amount of practice/feedback necessary for the acquisition of particular teaching behaviors. Uncertainty exists as to whether the experimentally determined amount of practice/feedback needed to acquire a skill is a function of (1) the number of practice/feedback sessions, or (2) an interaction effect with a second skill, or (3) a combination of the preceding possibilities. Future studies investigating the number of practice/feedback lessons necessary for the acquisition of a behavior could overcome this problem by presenting a single teaching skill at a time.

Finally, confounding the roles of instructor and evaluator may have resulted in the experimenter unintentionally biasing the results in favor of the intended outcomes. Though the presentation and feedback formats were held constant, it is possible that the experimenter's non-verbal behavior was more favourable toward those groups which, according to the design of the study, should have shown a substantial increase in a teaching skill. For example, an unintentional display of enthusiasm by the examiner may have encouraged subjects in the experimental group E_1 to improve their ability at asking high level questions, whereas a less enthusiastic approach toward student improvement in C_2 may have contributed partially to a curtailment in skill development. The employment of an instructor, who was unaware of the purpose of the study, to implement the training procedures would help to overcome this methodological limitation.

Although this procedure should assist researchers in overcoming the confounding influences that may result from combining the roles of instructor and evaluator in a single person, there remains the problem of the interaction effects between the type of instructor and types of students. Once replicated, experimental evidence has been used to delineate the most effective use of microteaching for the acquisition of specific teaching skills to be used in regular classrooms for the majority of student teachers, additional investigations should consider systematically the interaction effects between not only the type of student and type of instructor, but also the type of student and the instructional procedures. The complexity and singleness of an individual's personality ensures that not all students will benefit from the same instructional procedures nor from the same type of instructor.

Conclusion

A sample of fourth year Bachelor of Education student teachers practised the skills of asking questions that require pupils to use higher cognitive processes and redirection in five minute microteaching discussion lessons involving five fourth grade pupils. The salience of practice which includes feedback (self-assessment and examiner critique) was demonstrated over groups. The temporal factor between reteach lessons was not differentiated in comparisons between twenty-four hour intervals and forty-eight hour intervals. With the completion of two microteaching lessons with feedback the students had acquired the skill of asking high level questions in the practice environment. Once this figure has been confirmed with replicated results, researchers of the microteaching model

should proceed, on the basis of experimental evidence, to alter the training environment so that they might investigate (1) the nature and frequency of the proceeding training environments, and (2) the optimal number of practice lessons that students should teach in each of these settings to ensure that the skill of asking high level questions may be used in a regular fourth grade classroom.

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APPENDICES

APPENDIX A

Rules Observed When Scoring Low Cognitive and High Cognitive Level Questions

Questions requiring pupils to give back factual information without any form of manipulation or interpretation of the facts were considered low level. Higher cognitive questions included all questions which required the pupil to manipulate his knowledge or information in some manner before responding. Questions which influenced pupils to analyze information, to develop relationships among facts, to interpret, to suggest applications, to synthesize facts, to evaluate information etc., were considered high level. Procedural questions (e.g. "Would you open the door, please?"), not being part of the class discussion, were placed in neither category. General conversation not under the control of the teacher's specific redirecting or questioning skills was not recorded.

An arbitrary decision was made regarding high cognitive level questions that elicited low level responses. It was agreed that the pupil-response would either confirm or deny the coding of the questions. That is, the interactions of both student-teacher and pupil determined the question category. If the question was incomprehensible, or could not be answered because the entering behavior of a particular student or students was not sufficient, then the question was automatically low because it would only elicit either an unambiguous or incorrect answer, a yes/no response, or an "I-don't-know" response.

APPENDIX B

Rules Observed When Scoring the Skill of Redirection

(i) the second student who replied was counted as the first instance of redirection; the third student was the second instance, etc.

(ii) the redirection sequence was broken when the teacher asked another question.

(iii) redirection was maintained even if the question was extended to another pupil along with such prompts as:

"What else can you add?" "Are there any examples?"

"Can you explain further?", etc.

(iv) the redirection sequence was not broken if the teacher repeated the question, elaborated, or sermonized as long as the question had not been changed.

(v) when something new was added to the question, redirection was broken.

(vi) when a teacher asked the same student to explain his answer, this did not count as an instance of redirection. If a second student asked to elaborate upon a first student's answer, it was counted as redirection.

(vii) if the teacher returned to the original question after the redirection sequence was previously broken, it was *not* counted as a new question; rather, the first redirection of this repeated question was counted as a redirection on the original question.

APPENDIX C

Number of Redirections and Questions (High and Low Level Combined) for Pre- and Post-treatment Measures Across Groups

Group	N	Redirections		Questions	
		pre	post	pre	post
C_2	6	59	61	118	77
C_1	5	35	67	95	40
E_1	4	21	49	42	29
E_2	6	34	73	111	37
E_3	6	34	75	98	37

APPENDIX D

Frequency of Low and High Level Questions Asked by Each Student During Pre- and Post-test

		Pre-test		Post-test	
Group	Student	Low Level	High Level	Low Level	High Level
C_2	1	22	3	8	2
	2	6	9	13	6
	3	16	4	9	4
	4	12	8	9	5
	5	18	2	4	3
	6	14	4	11	3
C_1	1	16	7	3	5
	2	7	2	4	4
	3	19	2	7	2
	4	28	2	4	6
	5	9	3	1	4
E_1	1	9	3	3	6
	2	11	2	4	4
	3	8	3	2	4
	4	4	2	2	4

(Cont'd)

(Cont'd)

Group	Student	Pre-test		Post-test	
		Low Level	High Level	Low Level	High Level
E_2	1	12	4	0	6
	2	8	3	0	6
	3	21	7	0	6
	4	19	7	1	4
	5	19	0	1	4
	6	9	2	5	4
E_3	1	30	3	3	5
	2	11	2	0	4
	3	6	4	2	4
	4	10	1	1	3
	5	12	8	1	9
	6	10	1	0	5

APPENDIX E

Frequency of Low and High Redirections Performed by Each Student During Pre- and Post-test

Group	Student	Pre-test		Post-test	
		Low Level	High Level	Low Level	High Level
C_2	1	3	2	8	0
	2	4	9	3	5
	3	14	4	5	10
	4	4	6	3	9
	5	2	0	5	7
	6	10	1	5	1
C_1	1	5	4	3	14
	2	0	5	5	5
	3	1	1	5	4
	4	4	2	0	15
	5	10	3	0	16
E_1	1	1	1	3	13
	2	5	0	2	6
	3	3	2	5	6
	4	0	9	3	11

(Cont'd)

Group	Student	Pre-test		Post-test	
		Low Level	High Level	Low Level	High Level
E_2	1	1	6	0	9
	2	11	4	0	10
	3	3	0	0	20
	4	0	3	3	10
	5	2	0	6	5
	6	2	2	3	7
E_3	1	2	3	4	7
	2	6	6	0	19
	3	0	5	1	8
	4	2	0	3	14
	5	0	2	0	10
	6	7	1	0	9

APPENDIX F

PERSONAL DATA SHEET

1. NAME: _____

2. NATIONALITY: _____

3. AGE: _____

4. MARITAL STATUS:

SINGLE: MARRIED:

5. Province in which you received high school education: _____

6. Grade point average at University 1973-74: _____

7. Please check appropriate statement:

Live at home with parents or relatives: _____

Live away from home (family): _____

8. Annual income: (If you live at home with parents or relatives and are supported by them, please use parental income to answer question).

Below $ 3,000 _____

$ 3,000 - 6,000 _____

$ 7,000 - 9,000 _____

$10,000 - 15,000 _____

Greater than $15,000 _____

9. Number of brothers and sisters: _____

10. Number of brothers and sisters younger than self: _____

11. Please specify the amount of (practice) teaching experience you have acquired. This includes all teaching experience outside of university requirements: _____

12. Please indicate as accurately as possible the time spent teaching students at grade four level: _____

13. Please specify your teaching specialisation(s):

_____

_____

_____

APPENDIX G

Written Instructions Issued to Student Teachers Prior to Commencement of Student Teaching

MICROTEACHING PLAN B

The February - March microteaching experiences will be used for two purposes:

a) to present several teaching skills (using films of model teachers) and to give you the opportunity to practice these skills.

b) to collect information related to the question of whether or not microteaching is a suitable method for the training of teachers.

Please digest the following points carefully.

1. During the first week in the schools, each teacher will teach one microteaching lesson.

2. Each microteaching lesson, during February - March, will be of five minutes duration and involve five students. It is necessary that a discussion format be used and you should sit rather than stand during the lesson. The group of students to be used is listed on the time-table. The teacher for these children (also listed) will know which students belong to each group.

3. Upon completion of videotaping during the first week each school will, in turn, view a film during a specified lunch hour (see time-table) and then teach several microteaching lessons. The number of lessons taught by student - teachers will vary according to the school at which you teach.

4. The time-table for each school (excepting Westbrook) indicates that at least one microteaching session requires thirty minutes of your time. This additional time (following the five minute lesson) is to be used by each student for a replay of each lesson.

5. Prior to and following the showing of the films at each school, I will hand out written material which will explain in further detail the nature of the skills and the method to be used for revising your microteaching lessons.